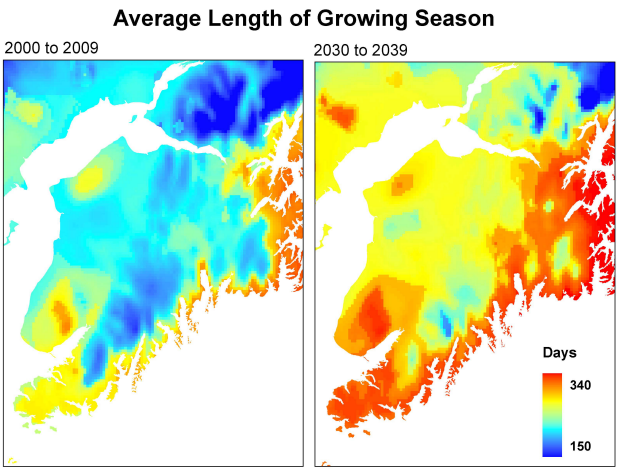
Mapping the future

by Dawn Robin Magness



On the Kenai National Wildlife Refuge, we are using forecasts to think about how ecosystems and species distributions might change in the future.

Last month, the House of Representatives narrowly passed a climate change bill. If enacted by the Senate, the bill will seek to reduce greenhouse emissions from current levels by 17% by 2020 and over 80% by 2050. Undoubtedly, there will be more lively debate about the costs, methods, and timeline of climate change mitigation.

Mitigation actions seek to reduce the magnitude and rate of climate change. Although mitigation is important to slow the pace of future change, Alaska is already experiencing climate change impacts. Alaska has warmed twice as fast than other regions of the United States over the past 50 years. A report by the U.S. Global Climate Change Research Program found average annual temperatures in Alaska have risen by 3.4°F and average winter temperatures have increased by a whopping 6.3°F.

Warmer winters might sound great when we think about the work we put into gathering and splitting firewood. However, these changes come with economic and ecological costs. For example, the shortened ice road season has a significant financial impact on oil and mining industries on the North Slope. Increased wildfire activity impacts infrastructure and human health. Wetland drying reduces or changes the locations for waterfowl breeding habitat and hunting opportunities.

On the Kenai Peninsula, documented climate change impacts have already begun. Closed-basin lakes are drying and changing the habitat available for waterfowl. Tree-line has risen, so less alpine habitat is available. The Harding Ice Field is shrinking and the increased silt and melt-water in Skilak Lake has reduced the plankton available for sockeye salmon fry to eat. In the 1990s, the largest spruce-beetle outbreak in the world occurred in south-central Alaska and is linked to higher summer temperatures and drought.

What can we do as mitigation efforts begin in Washington D.C.? In a word, we can adapt. Along with mitigation, adaptation is another tool for responding to climate change. Adaptation seeks to minimize negative effects and exploit any beneficial opportunities from climate change. Although we are beginning document climate change impacts on the Kenai Peninsula, planning for adaptation can be difficult because future conditions are uncertain. To reduce this uncertainty, climatologists use forecasts to try to estimate what changes are likely in the next 50 or 100 years.

What can we expect from climate forecasts? We don't have a crystal ball to know whether mitigation bills will pass and be effective in the United States, much less what other counties will do. To deal with a range of possibilities, forecasts use scenarios. Scenarios are storylines that describe very different future worlds. The Intergovernmental Panel on Climate Change, a scientific panel tasked to evaluate climate change risk, developed a widely used set of scenarios. To get a sense of the range possible future conditions, a scenario with accelerating greenhouse gas emissions can be compared to a scenario where emissions stabilize and then decline.

Scientists also need General Circulation Models (GCMs) for generating forecasts. GCMs use mathematical equations to simulate how climate is affected by interactions between the atmosphere, oceans, and the land surface. Scientists assess GCMs based on their ability to predict past climate conditions. GCMs are then used to forecast future climate conditions based the expected greenhouse gas emissions outlined in any given scenario. GCMs typically predict climate condi-

tions for 500km by 500km cells on the globe, which is a very coarse scale.

Working with colleagues at the University of Alaska, Dr. John Walsh has made the outputs of GCMs more useful for thinking about the future in places like the Kenai Peninsula. First, Dr. Walsh's team had to choose which GCMs to use. Many different GCMs have been developed by different research teams.

Different GCMs perform better than others depending on the region of interest, so Dr. Walsh's team evaluated 15 GCMs to compare how well they predicted actual temperature and precipitation for the years 1958 through 2000 in Alaska. They chose 5 of these models based on their performance and averaged their forecasts.

The next step was to "scale-down" the information from the 100km by 100km grid cells used in these GCMs to 2km by 2km cells that are more useful to land managers and communities. Dr. Walsh's team used weather station data, topographic maps, and local knowledge of climatologists to make these useful maps.

Managers and planners now have access to maps of Alaska that are forecasts of future climate conditions. The maps are available online from the Scenarios Network for Alaska Planning (SNAP). SNAP is a collaborative network of the University of Alaska, government agencies, and nonprofits. The mission of SNAP is to provide timely access to management-relevant scenarios of future conditions in Alaska.

As an example, I went to the SNAP website for data about the average days in the growing season on the Kenai Peninsula. I also downloaded a forecast of the growing season for 2030 to 2039. The forecast was based on the scenario where greenhouse gas emissions stabilize and then reduce. Even with effective mitigation of greenhouse gas emissions, we will likely experience a longer growing season in the future.

More days in the growing season is just one factor. We will likely see other changes like warmer temperatures, more variable temperatures, and changes in precipitation patterns. Thinking about these possibilities will allow us to experiment with and develop new opportunities. For example, some new crops may be possible with a longer growing season.

We all have experiences with weather forecasts from the evening news that are wrong. A sunny weather forecast can turn into a rainy day. However, forecasts are still useful for planning. We need these tools. They give us clues that can be used to look for changes and envision conditions that may be very different than what we see today.

Dawn Robin Magness is the GIS Manager and a Fish & Wildlife Biologist at the Kenai National Wildlife Refuge. She recently moved to Soldotna from Fairbanks where she completed her Ph.D. Her dissertation research focused on climate change adaptation strategies. Previous Refuge Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.